

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Hans-Georg Weigand, University of Wuerzburg

The Klein-Project – Webpage and Wiki

www.kleinproject.org

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

The main question:

Which digital materials do we need for the Klein-Project and how do we organize, develop and construct them?

The Klein Project

Home

The Project

His life

Klein Wiki

Felix Christian Klein was born in Düsseldorf, to Prussian parents. He attended the Gymnasium in Düsseldorf, then studied mathematics and physics at the University of Bonn 1885-1888. Klein received his doctorate, supervised by Julius Plücker, from the University of Bonn in 1893.

After he spent some years in Erlangen, 5 years at Munich's Technische Hochschule and some very tumultuous years in Leipzig (his health collapsed and he was plagued by depression), Klein accepted a chair at the University of Göttingen in 1908. From then until his 1913 retirement, he sought to re-establish Göttingen as the world's leading mathematics research center. Not he never managed to transfer from Leipzig to Göttingen his own role as the leader of a school of geometry. At Göttingen, he taught a variety of courses, mainly on the interface between mathematics and physics, such as mechanics and potential theory.

Around 1905, Klein began to take an interest in mathematical instruction in schools. In 1905, he played a decisive role in formulating a plan recommending that the rudiments of differential and integral calculus and the function concept be taught in secondary schools. This recommendation was gradually implemented in many countries around the world. In 1908, Klein was elected chairman of the International Commission on Mathematical Instruction at the Rome International Mathematical Congress. Under his guidance, the German branch of the Commission published many volumes on the teaching of mathematics at all levels in Germany.

The London Mathematical Society awarded Klein its De Morgan Medal in 1903. He was elected a member of the Royal Society in 1905, and was awarded its Copley medal in 1912. He retired the following year due to ill health, but continued to teach mathematics at his home for some years more.

Klein died in Göttingen in 1925.

Quelle: [wikipedia.org](#)

Quelle: [wikipedia.org](#)
Urheber: [LukasBauer](#)

The Klein Project

Home

The Project

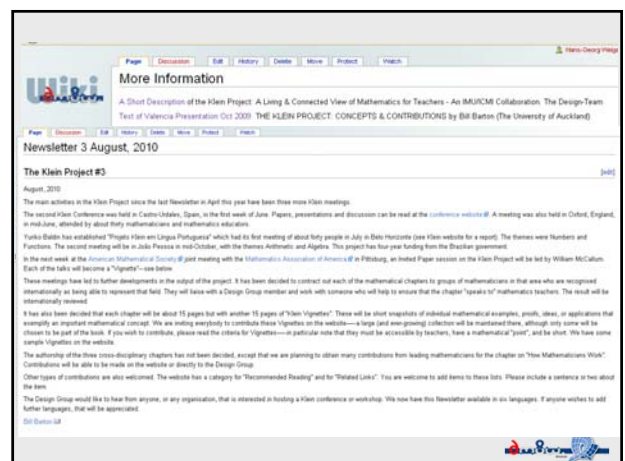
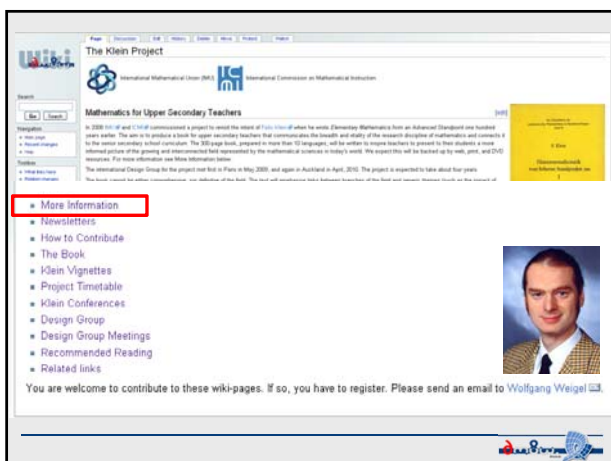
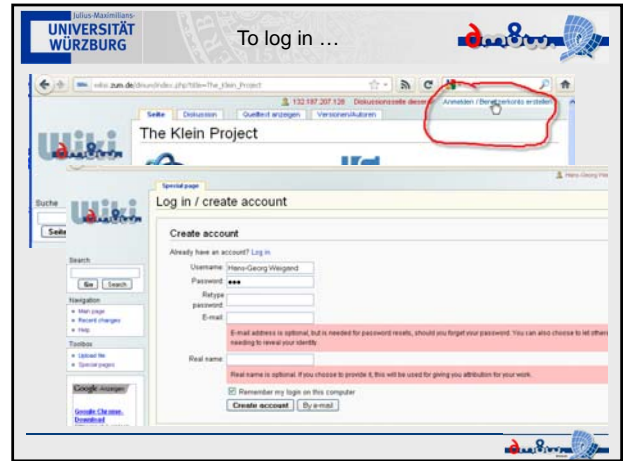
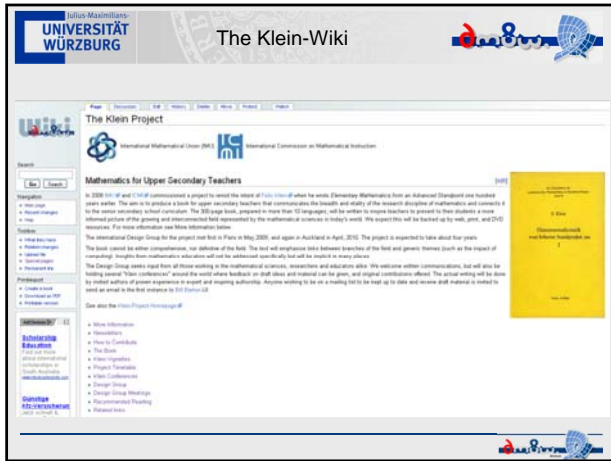
His life

In 2009 IMU and ICM commissioned a project to revisit the spirit of Felix Klein when he wrote Elementary Mathematics from an Advanced Standpoint. That is, to produce a book for secondary teachers that communicates the breadth and vitality of the research discipline of mathematics and connects it to the senior secondary school curriculum.

The international Design Team for the project met recently. The team confirmed the production of a 1000-page book written to inspire teachers to present to their students a more complete picture of the growing and interconnected field represented by the mathematics sciences in today's world. We expect this will be backed up by web, print, and CMV resources. The [project](#)

Comments are invited on the choice of Chapter titles (bearing in mind the comments above):

- Introduction
- Topic Chapters
 - Arithmetic
 - Logic
 - Algebra & Structures
 - Geometry
 - Functions & Analysis
 - Discrete & Algorithmic mathematics
 - Mathematics of Computation
 - Probability & Statistics
- Theme Chapters
 - Intradisciplinarity (i.e. internal connections)
 - Mathematics as a living discipline inside science and society
 - How mathematicians work



How to Contribute

Contributions of all kinds are welcomed by the Design Group. You are welcome to send material by email to [Bill Barto](#). At this time we are soliciting in particular **Klein Vignettes** and comments on the **Book Structure**. We expect to have **Klein Vignette Criteria**.

Type 1: Trajectories connecting school mathematics with advanced and recent aspects of the field of mathematics.

Type 2: Explanations of modern significant applications.

Both types should start with an Inspiring Example or Problem that connects to the culture of the school teacher (either The material from the field of mathematics should show teachers something beyond what they know (even if it may not Type 1 will need to have "transitional objects" or a "chain of linkages" that take the teachers to the edge of the ocean s Both types need to have in mind the reader listening and asking "Why is this important?", and the answer should be sc inside science and technology, or about how mathematics develops in general terms. It should have a mathematical m that there is mathematics hidden inside that topic.

The vignettes need to be written in the awareness of the role of technology without allowing it to dictate the content. All vignettes should be short and focused, most of them having 5-6 pages, at the maximum 10 pages. Vignettes shoul also encouraged. Attention should be put on providing references, especially those that take the topic further, and relat

The Book

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Klein Vignettes

Klein Vignettes are welcomed. Please submit them directly into this website under **Submitted Vignettes**. Please read the [How to Contribute](#) for Klein Vignettes as you prepare your submission.

We ask authors to include their name as "Originating Author", to acknowledge the first version of the vignette changes to a form to which they do not wish to be associated.

Submitted Vignettes will undergo an approval process by the Design Group. This process is not a new Originating Authors are donating their work to the Klein Project. The work is protected under the terms (We are still working out the best way to mount articles with mathematical diagrams and symbols on

Submitted Vignettes (Not reviewed at the moment)

- Heron Triangles and Elliptic Curves (Bill McCallum)
- Calculators, Power Series and Chebyshev Polynomials (Graeme Cohen)
- How Google works (Christiane Rousseau)
- Banach fixed point theorem and applications (Christiane Rousseau)
- Kepler's conjecture on the packing of spheres (Christiane Rousseau)
- Higher Dimensions (Markus Ruppert & Hans-Georg Weigand)**
- Random rigging for rowing eights and fours (Jerome Cohen)
- The concept of dimension (Christiane Rousseau)
- The tidiness of elementary mathematics (Chris Sangwin)

Approved Vignettes

Markus Ruppert, Hans-Georg Weigand (University of Wuerzburg, Germany)

Towards higher dimensions

Message

Mathematics makes the invisible visible!

- (1) A systematic extension of the concept of coordinates,
- (2) Projections of higher-dimensional objects on (hyper)planes,
- (3) Intersections of (hyper)cubes and a (hyper)plane.

Combinatorial considerations lead to the following relation for the number $N(n; k)$ of the k -dimensional "boundary cubes" of an n -dimensional cube (see e. g. Graumann, 2009):

$$N(n; k) = \binom{n}{k} \cdot 2^{n-k}.$$

| $n \backslash k$ | 0 | 1 | 2 | 3 | 4 |
|------------------|----|----|---|---|---|
| 0 | 1 | - | - | - | - |
| 1 | 2 | 1 | - | - | - |
| 2 | 4 | 4 | 1 | - | - |
| 3 | 8 | 12 | 6 | 1 | - |
| 4 | 16 | | | 8 | 1 |

Fig. 1: Projection of a square along the diagonal

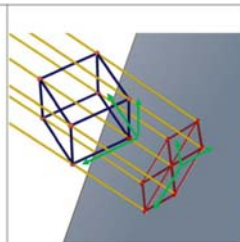
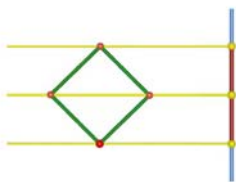
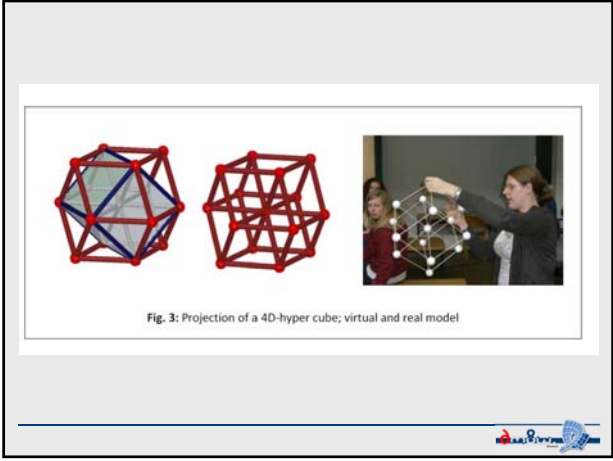


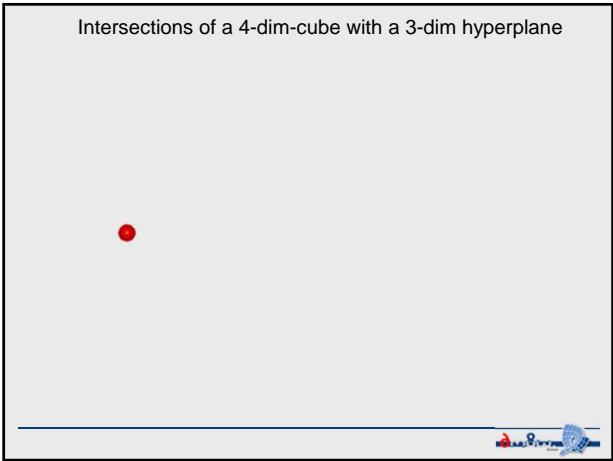
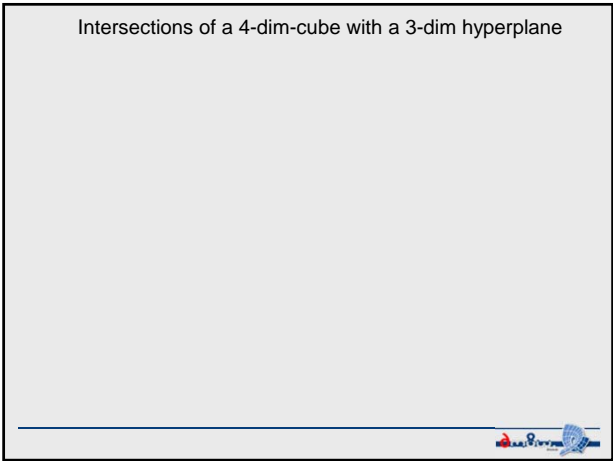
Fig. 2: Projection of a cube along a body-diagonal





Intersections of a cube with a plane

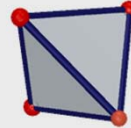
| | | | |
|-----------------------|---------------------|---------------------|---------------------|
| Shape of intersection | | | |
| Time | $t = \frac{3a}{4v}$ | $t = \frac{a}{v}$ | $t = \frac{5a}{4v}$ |
| Shape of intersection | | | |
| Time | $t = \frac{3a}{2v}$ | $t = \frac{7a}{4v}$ | $t = \frac{2a}{v}$ |



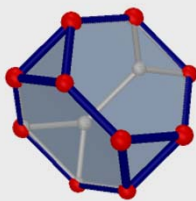
Intersections of a 4-dim-cube with a 3-dim hyperplane



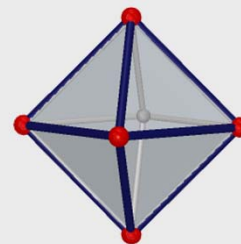
Intersections of a 4-dim-cube with a 3-dim hyperplane



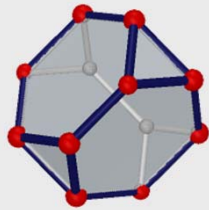
Intersections of a 4-dim-cube with a 3-dim hyperplane



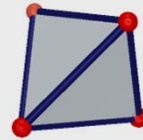
Intersections of a 4-dim-cube with a 3-dim hyperplane



Intersections of a 4-dim-cube with a 3-dim hyperplane



Intersections of a 4-dim-cube with a 3-dim hyperplane






Intersections of a 4-dim-cube with a 3-dim hyperplane




Intersections of a 4-dim-cube with a 3-dim hyperplane



Intersections of a 4-dim-cube with a 3-dim hyperplane

| | |
|---|---|
|  | <p>2011</p> <p>End February</p> <p>Establish a writing timetable</p> <p>Publishers contacted</p> <p>End July</p> <p>First drafts of some material for discussion</p> <p>End December</p> <p>Publisher decided</p> |
| <p>Search</p> <input type="text"/> <p><input type="button" value="Go"/> <input type="button" value="Search"/></p> <p>Navigation</p> <ul style="list-style-type: none"> ■ Main page ■ Recent changes ■ Help <p>Toolbox</p> <ul style="list-style-type: none"> ■ What links here ■ Related changes ■ Upload file ■ Special pages ■ Print/export tools | <p>2012</p> <p>End January</p> <p>Editing process begins</p> <p>End June</p> <p>Sample sections in English, Spanish, French, German, Mandarin ready for ICME-12</p> <p>End July</p> <p>Translation processes begin</p> <p>End December</p> <p>English version ready for publication</p> |
|  |  |

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Klein Conferences

Madeira (Portugal), 1-4 October, 2009

The first Klein Conference was held in Madeira, Portugal, from 1-4 October, 2009. It was attended by over 100 participants, predominantly from Portugal and Brazil.

Castro-Urdiales (Spain, near Santander) from 2-5 June 2010

The second Klein conference was held in Castro-Urdiales (Spain, near Santander) from 2-5 June 2010. The conference agenda is available at [Klein website](#), including (at [Programa PDF](#)) links to all the presentations and abstracts.

Oxford, 18th June 2010

A UK Klein Workshop was held on 18th June, 2010, in the Faculty of Education, Oxford. See [Chris Sangwin's page](#). See website [here](#).

Belo Horizonte (Brazil), July 2010

Yunke Baldin has established "Projeto Klein em Lingua Portuguesa" which had its first meeting will be in Jose Pessoa in mid-October, with the themes Arithmetic and Algebra.

Pittsburg, 6-7 August 2010

The James R. Litzel Lecture and an accompanying special session at MathFest 2010 were held on the above dates.

- [Project Klein em Lingua Portuguesa](#)
- [Pittsburgh AMSMAA MathFest 2010 Klein Session Presentations](#)

Palo Alto, 7-11 November 2011

The Website of the Conference PowerPoint presentations from that session are available at [this link](#).

- [Palo Alto AIM-conference 2011 Klein Session Presentations](#)

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- 3 **H. Behnke, F. Bachmann, K. Fladt (Eds.), Fundamentals of Mathematics (MIT Press, 1974)**
- 4 **Martin Gardner, Mathematical Puzzles and Diversions (Penguin, 1956)**
- 5 **Abert Cusick, Mathematical Connections: A Companion for Teachers (2005)**
- 6 **Doğanur R. Hıfzıoğlu, Gödel, Escher, Bach: An Eternal Golden Braid (Basic Books, 1978)**
- 7 **Zsuzsanna Uszók, Dick Stanley, Anthony Pennison, Elena Anna Marchisio, Mathematics for High School Teachers: An Advanced**
- 8 **Philip Davis & Reuben Hersh, The Mathematical Experience (Birkhäuser, 1991)**
- 9 **Philip Davis & Reuben Hersh, DesCartes' Dream: The World According to Mathematics (Houghton Mifflin, 1996)**
- 10 **Martin Gardner & Quinter Jackson, Frodo from Tree: BOOK (Springer-Verlag, 1998)**
- 11 **Lynn Arthur Steen (Ed.), Mathematics Today: Twelve Informal Essays. (Springer-Verlag, 1978)**



László Lovász, Trends in Mathematics: How they could Change Education? (2006)

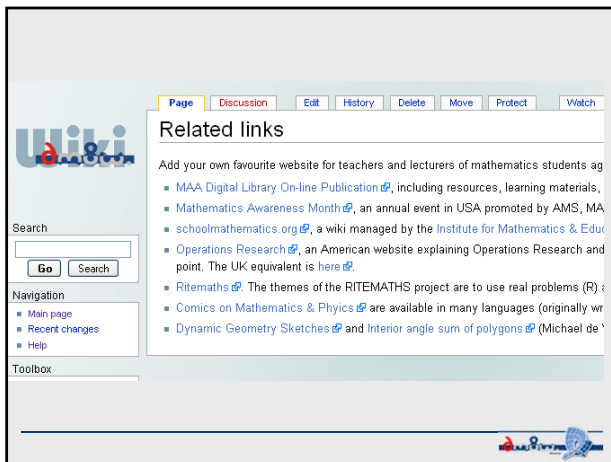
This paper is especially recommended. IMU President László Lovász' paper delivered at the *The Future of Mathematics 2006*

Felix Klein, Elementary Mathematics from an Advanced Standpoint (Cover 2004), 2 Vols

These are the first two volumes of the three-volume German edition, *Elementarmathematik vom höheren Mathematik aus* (J. H. Behnke, F. Bachmann, K. Fladt (Eds.), *Fundamentals of Mathematics* (MIT Press, 1974)

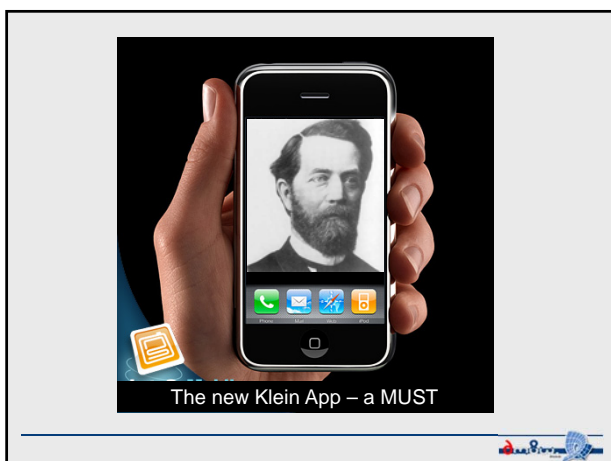
Translation from the German of *Grundzüge der Mathematik*, Vandenhoeck & Ruprecht, Göttingen, 1962. 3 Vols.



Questions

- How to design (change) the [web page](#)?
- Which contents should be integrated into the [webpage](#)?
- How to design the [vignettes](#)?
- Which digital materials should be integrated?
- Special materials: Movies, Apps, ...?
- How do we disseminate the project?
- Who's doing all these things?



Th@nk you!

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www.dmuw.de

